

SCIENCE.

FRIDAY, JANUARY 28, 1887.

COMMENT AND CRITICISM.

THE DEATH OF General Hazen, chief signal officer of the army, marks the close of the second period of the development of our weather-bureau. During the ten years from 1870 to 1880, while the bureau was under the direction of its first chief, General Myer, the labor expended upon it was given in greatest part to its organization. Stations had to be selected and their instrumental outfit determined; the time and kind of observations had to be decided upon, and observers instructed in their duties; the methods of reduction of data to practical form for use on a weather-map had to be adapted to the needs of a larger area than was ever before brought under the control of a single weather-office. Apart from the almost exclusively military constitution of the service during these years, its most marked characteristics in contrast with the European weather-services were the large sums of public money devoted to its support, the system of tridaily observations, and the absolute control exercised over all telegraphic lines in the collection of reports, in virtue of the law of 1866. Its maps were thus prepared more frequently and more promptly than weather-maps are abroad, and were admired all over the world.

General Hazen took charge of a highly developed service, and turned his efforts in two directions that to most persons appeared quite contradictory. He insisted on the need of military organization, and at the same time introduced numerous and important improvements that had nothing military about them. But during his administration, public discussion was frequently turned to the advisability of 'civilizing' the weather-bureau, for its work was not as successful as was desired. A committee of the National academy of sciences reported in favor of the change, the then secretary of war urged it, and a joint congressional commission recommended it, three members of the commission advising a gradual, and three an immediate, transfer from mili-

tary to civil authority. Popular opinion very generally supported these recommendations, and the chief objections to them came from the military element of the service itself. All the official declarations of the service maintained to the last that a military organization was essential to success in weather-prediction. It might be forcibly contended, on the basis of published statements in the annual reports, that the service had for its first object the availability of its entire force in case of war, were it not that its whole public work refuted this theory. The real work of the service is the announcement of the approach and force of storms throughout the United States for the benefit of agriculture and commerce in time of peace.

The people at large have taken a great interest in the government weather-bureau, and desire to see its work continued and its predictions improved. They would be glad to see an extension of scientific study in its offices, for on such study all its chances of better success depend. The opening of the third period in its history will therefore be watched with the deepest interest. The needs of the service must be thoroughly and deliberately considered. Immediate action, resulting in the appointment either of a military chief or of a civil director, would be deprecated on all sides, for the interests involved are too great to be endangered by hasty decision. Moreover, there is a very general desire, on the part of meteorologists and of scientists generally throughout the country, that they should at least be heard in the matter before decision is reached, so that whatever plan of future organization is adopted shall be based on full and open discussion. Deliberate action and authorized opportunity for consideration of scientific as well as of military methods are therefore of the first importance. It should be the earnest effort of all who have watched the development of the signal service thus far to secure these guaranties of its further progress.

MR. ATKINSON'S SECOND ARTICLE in the *Century* magazine, on 'The relative strength and weakness of nations,' is just as interesting as the first, to which we called particular attention at the

time of its appearance. In the present paper Mr. Atkinson considers the sources of the weakness of nations governed by dynasties, and presents some conclusions that must sound strange enough to the adherents of the 'blood and iron' policy. The writer also indorses Professor Seeley's conclusion that nearly all the European wars of recent times have originated in the desire of one nation to dominate a continent, or part of a continent, in order to build up colonies the commerce of which might be controlled by the mother-country. Mr. Atkinson points out that the fundamental fallacy here is economic, and consists in regarding commerce as a sort of war in which what one nation gains, others must lose. It was the international jealousy arising from pursuance of this policy that gave us for a mere song the vast territory embraced in the Louisiana purchase. This war-waging policy has resulted in the raising of funds by mortgaging the future through the medium of a national debt; and this, says Mr. Atkinson, has now become the chief source of the weakness of nations. He shows that the same century that has seen the European national debts increase from \$2,600,000,000 to over \$22,000,000,000 has also seen Spain, Portugal, Austria, and Greece become bankrupt, and Russia without credit.

Large as our national debt seems, and is when compared with our financial history previous to the rebellion, it is small in comparison with the national debts of Europe. Indeed, as Mr. Atkinson says, when at its highest point in 1865, it was \$84 per capita, an average which is equalled by the debts of the commercial and manufacturing states of Europe to-day. And while we have, omitting Alaska, 32.7 acres per head of population, Great Britain, Germany, France, Italy, Holland, and Belgium have only 2.8 acres per capita. On the other hand, while our national debt is only 73 cents per acre, that of the above-mentioned countries is \$30.06 per acre. The force under arms in those countries, omitting the reserves, is at the ratio of one man to each two hundred acres, and the annual tax for his support averages \$1.10 per acre. With us the ratio is one man to fifty-one thousand acres, and the annual tax for his support and for all other military purposes is something over three cents per acre. The war-waging countries have obtained, however, one advantage over us, which is probably due to the extent and perfection

of their military systems; and that is, that while it takes \$1,600 a year to sustain each man in the army and navy of the United States, — including the cost of ships, fortifications, navy-yards, and so forth, — the continental nations do it for \$223 per man.

Mr. Atkinson next proceeds to establish a comparison between the product per capita of European countries and that of the United States, at its measure in money. In this problem he takes the known factors to be the relative rate of wages paid in the countries considered, the relative amount of national taxation per capita, and the assumption that the value of the per capita annual product of the United States is two hundred dollars' worth. From these data Mr. Atkinson figures out the value of the product per capita of other countries by adding to the original elements of cost — the sum of the current rates of wages and the per capita taxes — from five to fifteen per cent as the corresponding profit. As a specific example of this computation, we have the following: "Assuming that one person sustains two others in France as well as in this country, we know first that the average wages in France are not more than sixty per cent the rate of wages in this country. We also know that national taxes are eighteen dollars per head in France, and less than five dollars here. We need, therefore, only to establish the rate of profit which will induce the employment of capital in the arts which can be established in France, in order to reach an approximate estimate of the average value of the product of each person employed in productive industry." Then, taking any group of skilled artisans in this country who earn two dollars a day, each supporting two other persons, the final value of the product of one such workman, following the method above outlined, would be six hundred and sixty dollars, divided into, profits, sixty dollars; taxes, fifteen dollars; net wages, five hundred and eighty-five dollars. The gross value of the French workman's product, similarly computed, is found to be four hundred and fourteen dollars, of which fifty-four dollars is diverted for taxes, and fifty-four dollars for profits.

Many of the other statistics and conclusions are of equal interest with the above, but we have not space to quote them all. For example: if the "product per capita of the United States may

be valued at two hundred dollars' worth, that of England, with its income from foreign investments added, may not exceed one hundred and seventy-five dollars' worth; that of Great Britain and Ireland combined may be assumed not to exceed one hundred and fifty dollars' worth; that of France as not exceeding one hundred and twenty dollars' worth; that of Germany as not exceeding one hundred dollars' worth; that of Italy as not exceeding eighty dollars' worth; such being substantially the ratios which the average rates of wages, with the per capita national taxation added, bear to each other, and to the wages and taxes of the United States, with corresponding profits added in each case." Again: at the ratio which the national taxes now bear to product in the United States, the actual work required to sustain all the functions of the national government, directly or indirectly, is that of 500,000 men; whereas, if our ratio were that of England, the labor of 1,348,000 men would be required; if it were that of France, Germany, or Italy, the labor required would be that of 3,000,000, 2,400,000, or 2,950,000 respectively. Mr. Atkinson's final conclusions are full of interest and importance, and merit close attention and study.

IN THE ISSUE of this journal for Jan. 7 will be found a formidable list of papers read before the Indiana academy of sciences at its last meeting on Dec. 29 and 30, 1886. An examination of the titles, together with the well-known scientific reputation of some of the authors, proves that there is a good deal of vitality in science in Indiana at the present time. Not many states west of the Alleghenies can boast of a more vigorous scientific society than this: indeed, the line might be drawn farther east without including one. The Indiana academy, although enrolling more than one hundred members, most of whom are actively interested in scientific work, was organized only a year ago. It doubtless owes its existence to the enthusiasm of the secretary of a village society of natural history, Mr. Amos W. Butler of Brookville, who, in the summer of 1885, assumed the labor and expense of the issue of circulars, appointing a meeting at the capital of the state on Dec. 27 of that year, and making all preliminary arrangements. With such men as Kirkwood, Jordon, Coulter, Owen, etc., as a nucleus, the academy was at once clothed with a dignity and character which drew to it nearly all in the state who were engaged or interested in scientific research. The

second meeting, held a few weeks ago, was largely attended, the membership was greatly increased, and the society appears to be starting upon a career of usefulness, which it is hoped may be a long one.

As might be expected, the natural history sciences have by far the largest number of votaries among its members at present. This is the result of example and environment; but mathematics, physics, astronomy, chemistry, etc., already have their representatives in the state, and will not be found slow to claim their share of the yearly programme. The great danger to which the academy is exposed is the possible loss of interest after the novelty of the thing has worn away. Let it not be in a hurry to increase its membership, and particularly let it be slow to follow the example of so many young societies in breaking up into a half-dozen or more 'sections,' none strong enough to stand alone, while all might do well together. The greatest good which such a society can do is to be found in the inspiration which it affords young men who attend its meetings and breathe its atmosphere. A society similar to the Indiana academy, well directed and full of vigor, in every state of the union, would be of incalculable benefit to the science of the country.

ACCORDING TO PROFESSOR BAIRD'S annual report, the work of the Smithsonian institution during the past year has been carried on effectively but quietly, and without any incidents of special importance. The routine work seems to have increased largely, for the system of international exchanges now requires the constant labor of nine persons, while that of two formerly sufficed; and the correspondence, which also used to need but two persons to attend to it satisfactorily, now needs five. The urgent necessity for additional room for the government collections, and a congressional appropriation for its provision, are emphasized by Professor Baird, who says that a new museum building, equal in size to the present one, would scarcely furnish the needed accommodations, so rapid is the increase of the government collections. The lack of explorations during the past year is ascribed to lack of means to undertake any thing of magnitude. The publications of the year are commented on, and some interesting statistics given as to the working of the system of international exchanges. During the

past fiscal year there were 764 boxes of foreign transmissions, 14,496 parcels of domestic exchanges, and 143 boxes of government exchanges handled by the institution. Over two hundred thousand persons visited the Smithsonian institution and the national museum during the year.

MUCH DIFFICULTY has been experienced in accounting for the occurrence of cases of contagious diseases, when, so far as could be ascertained, no exposure to any pre-existing case had occurred. These instances have been regarded by some as evidence of the possibility of their originating spontaneously. M. Verneuil has suggested a theory which, if true, would account for such anomalies. The microbes of disease, according to this view, remain in the skin and other portions of the body in a state of quiescence, and may continue thus inactive for years. By some means, as yet inexplicable, these microbes are aroused to a condition of activity, reproduce themselves in great numbers, and set out on their deadly mission. It is, in the absence of evidence to the contrary, much more reasonable to suppose, that, in the obscure cases in which exposure has not been recognized, such exposure has actually occurred, than to adopt a theory like this, which has not the slightest basis for its existence. If all cases which cannot be traced to their source were to be explained in this way, it would be the rule rather than the exception. A physician who had had large experience in an English small-pox hospital declared that not one case in twenty was capable of being referred to any known source of infection, the disease being ascribed by the patient to cold, fatigue, or some other innocent circumstance. The instance referred to by Sir Thomas Watson, in his essay on 'The abolition of zymotic disease,' should be a constant reminder to those who would refer the appearance of these diseases to a spontaneous origin. In 1829 a prisoner in Millbank penitentiary was attacked with small-pox, under such circumstances that it was thought no possible exposure could have taken place, and for thirty years the case was quoted as proof of the possible spontaneous origin of small-pox. In 1860 the fact for the first time became known that the physician of the penitentiary had come directly from a case of confluent small-pox in a neighboring town to the prisoner's cell, and had undoubtedly been the carrier of the disease.

THE SUBMERGED TREES OF THE COLUMBIA RIVER.

THE attention of many tourists who have traversed the magnificent valley of the Columbia River through the Cascades, has been called to two phenomena which have excited their interest. One is the occurrence of submerged trees in the bed of the river: the other is the slow lateral creeping of the road-bed and track of the Oregon railway and navigation company. During the last summer I had an opportunity to make a brief study of these two subjects, and, as they are likely to prove of increasing interest, it may be worth while to recite the results of the examination.

The Columbia enters the Cascade barrier three or four miles below the Dalles. The platform of that range here has a width of eighty miles. From the Dalles to the Cascade Locks, a distance of over fifty miles, the Columbia flows as a broad, deep, quiet stream, with a sluggish current at low water. Its course resembles that of the Hudson through the highlands; and this fact is at once suggestive, because the passage of rivers through mountain-ranges is generally swift, and broken by many rapids. If it is otherwise, there is almost certainly an interesting reason for it. The Cascade Locks are situated almost exactly on the axis of the Cascade range. Here is a cataract which has always been an insurmountable obstacle to navigation; for, within a distance of a few hundred yards, the river makes a descent of about thirty feet. The government is now building a short canal with large locks, to enable steamboats from below to reach the still waters above. Beginning at a point about a mile and a half above the cataract, the traveller, as he sails up the river, observes many old stubs protruding from the water and from the sand-banks, laid bare during the low stages of the river. They are seen for a distance of thirty miles, recurring at frequent intervals, here clustered thickly together like the piles of an old wharf whose superstructure has decayed and vanished, there with wide intervals between them. During high water these tree-trunks are entirely submerged. An examination of the wood serves to identify them with the living species of fir which form the forests upon the mountains and cliffs round about.

These submerged trees, together with the long still reach of water above, at once suggest that an obstacle has been placed athwart the stream, forming a dam which converted the river-valley above it into a long narrow lake, and that the rising water submerged an old forest of which these trees are the vestiges. Indeed, this is the only explanation which suggests itself. It is strongly

corroborated by many other circumstances which need not be enlarged upon here. No geologist who has visited the locality has ever doubted, so far as I know, that this is, in general form, the true explanation. The only question which arises is about the nature of the obstacle which has dammed the river. Dr. Newberry, who visited the place in 1855 in connection with the Pacific railroad surveys, suggested that it might be due to the slipping of the bank of the river into mid-stream at the Cascades, thus throwing the current upon the southern bank. This idea has diffused itself among the people of the neighborhood, and is frequently spoken of as the *vera causa*. In support of this view, reference is frequently made to the second fact; viz., the slow lateral creeping of the railroad-track on the southern bank of the river.

Desiring to see these phenomena, which seemed to promise much instruction, I made a visit to the place, and devoted a couple of days to their examination. As regards the creeping of the railroad-track, the explanation is patent as soon as the spot is visited. The place is situated on the south bank, about a mile below the cataract. The materials which are creeping are felspathic sands, deposited by the river itself in irregular strata, and now undergoing rapid decomposition and kaolinization. The products of decomposition become a smooth slimy clay; and having a rather steep front toward the river, which is here a swift and powerful torrent, the slope of the bank is a little too steep for stability. The materials, being of a somewhat unctuous character, flow easily with a slow glacier-like motion. The phenomenon, however, is a local one, limited to a stretch of only a few hundred yards, and does not occur anywhere else in the neighborhood, so far as I am aware. The bed-rock beneath it is disclosed, and there is no indication that it participates at all in the motion: on the contrary, the indications are very plain that it does not. It also became evident, that, whatever might be the origin of the obstruction which has backed up the Columbia River for nearly fifty miles, this particular phenomenon has had nothing whatever to do with it; though possibly it may be, and probably is, a remote consequence of the obstruction. It certainly is not the cause.

In looking upon the north bank for indications of a slide which could have precipitated any obstruction across the channel, I was unable to find any. On the contrary, the more carefully the ground was studied, the more difficult it seemed to reconcile this supposition with the facts; for there is no steep elevated ground, from which an obstructing mass could have slid, nearer than

three miles. The river-valley is here very wide, and north of the river lies its ancient flood-plain, which consists of ancient lavas and conglomerates in heavy masses, planed to an approximate rough level, with patches of river-gravel and sands scattered over it. The study of this old flood-plain disclosed facts which seemed to furnish a much more satisfactory solution of the problem.

Beginning at a point about a mile above the cataract, this flood-plain is seen to ascend as we go down stream. If the proper stand-points are selected, this slope in the wrong direction is conspicuous to the unaided eye. But we need not rely upon such a means of verifying the fact, for the relation of the river, as it now runs, to the older flood-plain, tells the story with emphasis. A mile above the rapid the old flood-plain is no more than thirty feet above the water; a mile below the rapid it is about two hundred feet above it; while the fall of the river itself in that interval is not more than forty feet. The inference seems decisive. There has been an uplift of the entire platform athwart the river-valley in the shape of a very flat anticlinal arch. The width or span of this arch is about five and a half miles, and the eastern branch of the flexure is steeper than the western. The displacement is not recent in a historical sense, but it is probably post-glacial.

The effects of such an obstacle would be manifold. Not only would it dam the river, but it would set up below the cataract an action which it is important to consider. A great river, thus obstructed, at once attacks the obstacle with immense power. And the more pronounced the obstacle, the more vigorous the attack. The Columbia has already cut through it a low, inner gorge somewhat similar to that of the Niagara River below the falls. The rapid at the locks is steadily receding, and, if no further displacement occurs, it will probably require not more than a century or two for the river to have cleared a passage deep enough to drain the slack-water reach above. The work of cutting a passage through the obstruction five and a half miles in length is nearly complete. That the dam was once higher than now, is also to be inferred. Year by year it is getting lower. The effect of the obstacle upon the slack water above it is also plain. The flow of the water being retarded, it drops its sediment, and the river-bed is gradually built up. Thus the trees which grew along the flood-plain before the upheaval were not only submerged, but were buried in sand and gravel. When the dam was higher, they were more deeply buried than now. As the dam is gradually cut down, the trees are slowly exhumed again. But it is well known that trees submerged in fresh water and buried

in silt may last for thousands of years. Only when brought into the open air again does the process of decay go on with ordinary rapidity.

It is no light thing for any observer to feel obliged to differ from Dr. Newberry concerning the interpretation of facts in the field. It has been my fortune during the last three years to traverse regions previously trodden by him in New Mexico, Arizona, California, and Oregon, and I have left them with a profound admiration for the sagacity and the wonderful accuracy, rapidity, and penetration with which he mastered the facts. This, I believe, is the only instance in which I have been led to a conclusion differing in any important respect from his.

C. E. DUTTON.

THE HEALTH OF NEW YORK DURING DECEMBER.

THE department of health of the city of New York estimated that the population of the city on Dec. 1 was 1,457,356, or nearly one and one-half millions of inhabitants. Of this number, 3,502 died during the month. This latter statement is not strictly accurate, as in it no account is taken of the natural increase in the population, which, over and above those who die during the month, is not far from 3,300, or more than 100 each day. As compared with November, there were 426 more deaths in December. The greatest mortality on any one day was on the 6th, when 144 persons died. The deaths due to diarrhoeal disease were but 65, the smallest number since the month of April. Of children under five years of age, there were 1,531 deaths, 241 more than in the preceding month. Consumption caused 478 deaths, a slight increase over November; diphtheria, 218 deaths, 30 more than in the previous month; and scarlet-fever, 23 deaths, the identical number of deaths which the November records charge to that disease. As will be seen by a glance at the chart, measles figured very prominently among the mortality factors, causing 271 deaths, or more than scarlet-fever and diphtheria together. During the month of November there were 166 deaths due to measles.

The highest temperature of the month was 55° F., on the 24th at 10 P.M. This is not so high by five degrees as the corresponding month in 1878, which was the lowest maximum for the decade; the average for the ten years being 66.2° F. The minimum reached by the mercury was 13° F., on the 5th at 6 A.M., and again on the 17th at 8 A.M. During no December since 1877 has the thermometer been so low, while the average for the decade is 20.8° F. It will thus be seen that De-

cember, 1886, was an unusually cold month as compared with the corresponding month for ten years past. The amount of rainfall was 2.79 inches, including 10½ inches of snow, 5½ of which fell in one day, the 5th. During December of 1885, snow fell on but one day, and then in such small quantity as to make its measurement impossible. In the previous year, 10½ inches of snow fell in December, and in 1884 the amount was 22½ inches. The average December rainfall for the ten years commencing 1877 was 3.37 inches.

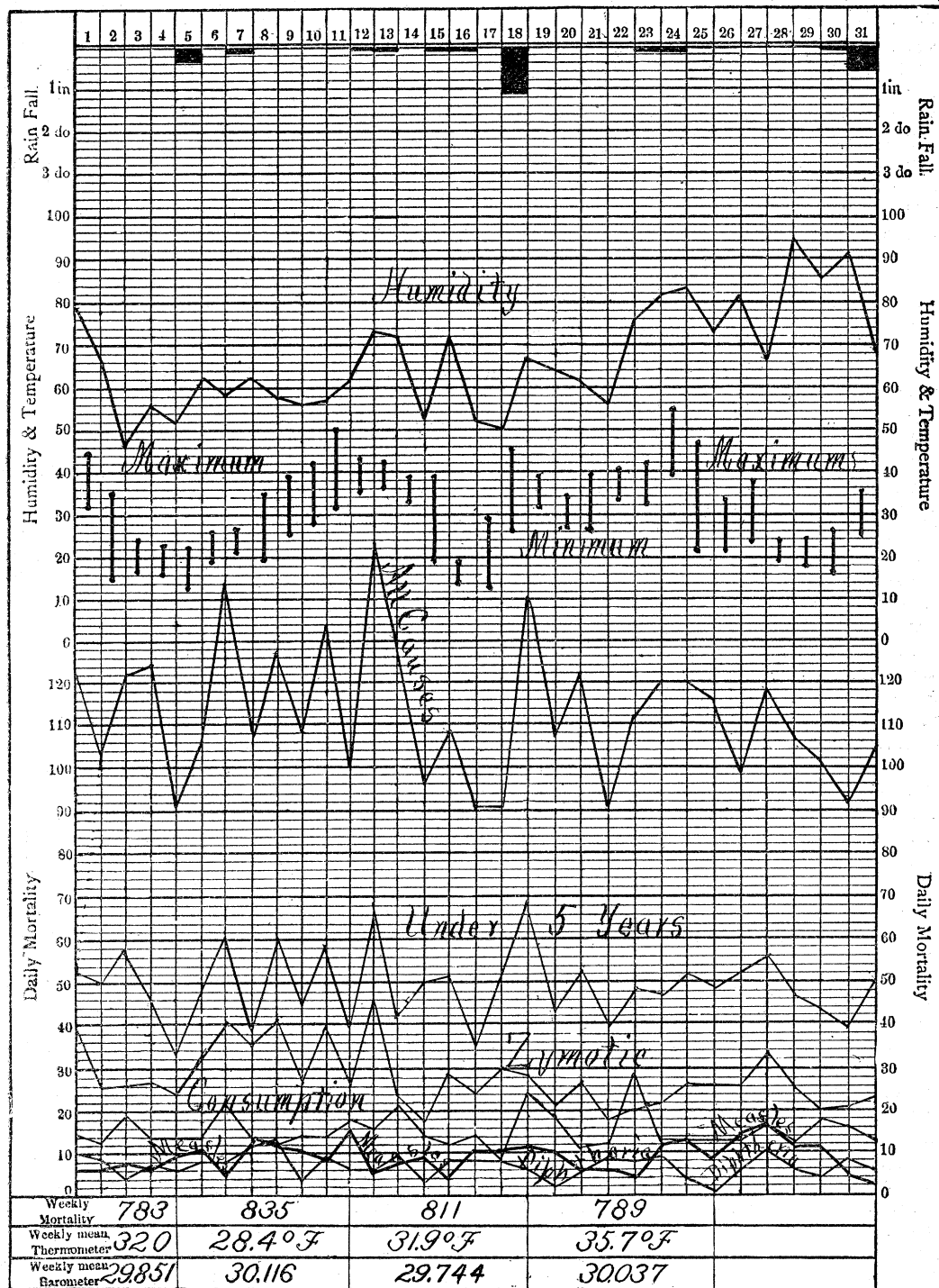
The following tables are of interest as showing the total mortality during the year ending Dec. 31, 1886, as compared with 1885:—

Deaths in New York for 1885 and 1886.

	1885.	1886.
Under 5.....	15,267	16,121
Zymotic.....	9,100	9,660
Scarlatina.....	559	271
Measles.....	736	663
Diphtheria.....	1,325	1,727
Typhoid.....	294	325
Diarrhoeal.....	3,426	3,494
Phthisis pulmonalis.....	5,196	5,477
Total.....	35,682	37,351

1886.	DEATHS FROM											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Scarlatina.....	49	43	42	49	44	29	25	15	11	18	23	23
Measles.....	5	2	8	10	17	26	58	36	21	48	166	271

Scarlet-fever caused fewer deaths in the former than in the latter, while diphtheria and typhoid-fever have been more fatal. Measles has of late excited a good deal of public alarm, and justly so, as shown by the table. While in January it caused but 5 deaths, decreasing to 2 in February, and not notably increasing until the summer, when November set in, the mortality suddenly rose to 166, and continued its upward course in December, carrying off 271 persons. The total mortality of the year was less than in 1885, but more than one-third of it took place in the month of December, and more than two-thirds in the two months of November and December. Consumption (phthisis pulmonalis) is, as usual, at the head of the column of the causes of death. The researches of Koch and others, which have



cleared up many obscure points in the causation of this disease, have not as yet shown us how to materially reduce the number of victims who are annually claimed by it. That more than five thousand persons annually die in a single city from one disease is a sad commentary on sanitary science, and yet the best of minds are at work to solve the problem of the measures which must be adopted to diminish its ravages. That three thousand and more individuals, mostly children, died from diarrhoeal diseases, does not surprise one who is familiar with the intense heat of our midsummer; and in great measure this is largely beyond control. It is true, something may be done to reduce this mortality by visiting the poor sick and prescribing for them, and by giving them opportunities to breathe the fresh air of the country and the sea; but, when all has been done that can be, diarrhoeal diseases will still carry off the little ones by the hundreds and thousands, if the temperature and the humidity are favorable for their development. Diphtheria, which was unknown in New York until the year 1852, caused 1,727 deaths in 1886, and has, ever since its appearance, figured prominently in the mortality returns, its origin unknown, and its treatment not understood even by the best of physicians, — a disease dreaded by the laity and the profession alike in all parts of the world where it has obtained a home. It should, however, be constantly borne in mind, that although this class of disease cannot be eradicated, still, if all restraint were removed, their mortality would probably increase tenfold. In view of this, the department of health, whose function it is to keep watch of the localities in which these diseases do most abound, should receive the hearty co-operation of every member of the community, and be furnished by the authorities with ample means to carry on its beneficial work.

PARIS LETTER.

At yesterday's meeting of the Academy of medicine, Professor Grancher read a paper on the case of the man Réveillac, who died of hydrophobia after preventive inoculation, in which he corrected some erroneous statements made by Professor Peter at a previous meeting [see p. 96]. It appears that Réveillac submitted to only nineteen operations instead of thirty-six, as had been stated, and the treatment was much milder than in more serious cases. Moreover, the first information received at the Pasteur laboratory, of the unfortunate man's death, was from M. Peter's paper at the academy.

According to Professor Béclard, dean of the medical school, there are at present 108 women

studying medicine in Paris. Of these, 83 are Russian, while only 7 are natives of France. The total number of female students would be much larger were it not for the necessarily stringent rules as to admission. Two women are among the present competitors for posts as assistants in the hospitals, of whom one, Miss Klumke, will doubtless succeed, much to the discomfiture of her male competitors. She is one of Vulpian's students, and has already published many interesting memoirs on neurological subjects.

Telephonic communication between Paris and Brussels will shortly be established; recent experiments between those cities, with wires of bronze instead of iron, having given excellent results. The distance is 330 kilometres, and the same wires will be used for both telegraphic and telephonic purposes, as it has been demonstrated that one wire can be used successfully for the simultaneous transmission of both kinds of despatches.

At a recent meeting of the Biological society, M. Laborde, director of the physiological laboratory of the medical school, read a paper on the use of water in fasting experiments. It is known that Succi and Merlatti drank water freely during their long fasts, and the public was divided in opinion as to the effects of the water. M. Laborde has ascertained by experimental tests that water is of great value in sustaining life during prolonged fasts. Two dogs, in good health, of the same age and breed, each weighing 15½ kilograms, were selected, one of which was entirely deprived of both food and drink, the other being given only a litre of water daily. Dog No. 1, that deprived of both food and water, died on the twentieth day, after having lost 7½ kilograms in weight. The other dog was well and lively on the fortieth day, though it had lost nearly 8 kilograms. It would undoubtedly have been able to live still longer on its water diet; but after its 40-day fast it was treated to a good meal, when, without apparent ill effects, it disposed of 1,200 grams of soup and 1 kilogram of meat. The dog is now doing well.

Two or three new books deserve notice. One is a translation, by Dr. H. de Varigny, of Preyer's 'Die Seele des Kindes,' a very interesting work, dealing with its subject in an entirely new and thoroughly scientific manner. Mr. Preyer is by training a physiologist, and has made a great many interesting physiological observations concerning children. It may be remarked that a French translation of another book of his, 'The physiology of the embryo,' to which the first-mentioned work is in many respects a sequel, will soon be brought out by the same publisher, F. Alcan. Preyer's books are very valuable, and it

must be said that he was the first to study in so scientific and severe a manner, and with such persevering patience, the subject treated of in 'Die Seele des Kindes.'

A book on animal magnetism, by MM. Binet and Féré, has recently appeared. It is really a book on hypnotism, as most phenomena ascribed to animal magnetism are of an hypnotic nature. The book is a good one. After some preliminary chapters devoted to the experiments of Mesmer and others, the authors speak of modern hypnotism, of the different methods of inducing hypnotic sleep, and of the symptoms and degrees of this sleep. They then give a theory of hypnotic suggestion, with a long review of the phenomena produced under its influence. A specially good chapter treats of the therapeutic and pedagogic applications of hypnotic suggestion. The book treats the subject fairly and fully, and will prove useful. Another new book, on hygienic dietetics, is from the pen of Prof. G. Sée. It begins with an exhibit of the comparative nutritive powers of different foods and a physiological study of the alimentary process. The rest of the book is devoted to the practical treatment of diseases by a judicious choice of foods. M. Sée is well informed upon the subject, and his book is consequently valuable, although it does not contain much original matter.

Paris, Jan. 13.

NOTES AND NEWS.

THE first annual convention of the Society for the prevention of the adulteration of foods, drugs, and medicines met in Washington last week. The object of this society is the establishment of a certain fixed standard for every article of food, drink, and medicine, with the requirement that all articles not up to the standard shall be so marked by a label. About one hundred and twenty-five delegates were present from all parts of the country. Mr. H. Wharton Amberling of Philadelphia was elected president, and Mr. Elisha Winter, secretary. The president read his annual address, in which he spoke of the want of proper legislation on the subject of adulterated food, the sale of which, he claimed, produced nearly all the cases of kidney-trouble in the land.

— The secretary of the treasury has transmitted to congress the estimates of deficiencies in appropriations for salaries and expenses of the National board of health during the present fiscal year, amounting to \$7,500. In a letter accompanying the estimates, the secretary of the board earnestly urges the importance of making the appropriation requested, but says, in case it is deemed unde-

sirable to continue the work which has for its object the preservation and improvement of the health of the people, the laws devolving such duties upon the board should be repealed.

— The fine, large, gold medal given to General Grant for distinguished services in the Mexican war, now at the national museum, is bogus, having a specific gravity of only seven instead of sixteen.

— A memorial has been presented to congress, signed by prominent literary and scientific men and representatives of several historical societies, setting forth the great value and importance of a full and accurate digest and catalogue of the numerous documents found in public and private archives of Europe relating to the early history of the United States, and especially to the treaty of Paris in 1763, and the treaty of peace between the United States and Great Britain in 1783. Most of these documents are unknown to the American student, and but few of them have ever been copied, owing to their inaccessibility. Mr. Benjamin Franklin Stevens of London has, after many years' labor, prepared a descriptive catalogue of over 95,000 separate papers found in the archives of different European countries. The secretary of state recommends to congress the purchase of this descriptive catalogue, and adds, "Without its favorable action, not only will the completion of the work be doubtful if not impossible, but the fragment now prepared would probably remain practically valueless." Mr. Stevens, in a letter to the secretary of state, says that the work has become too great for any individual to undertake alone, unless a man of wealth, and that when complete the index will probably comprise 150,000 documents, and fill 20,000 royal octavo printed pages.

— Lieutenant Pillsbury, commanding the *Blake*, has started south for the season's work, and will run several lines of current observations from Cuba to Yucatan, and from Cuba to Florida Reef, and thence northward to San Antonio. This is a continuation of the work of last year, which was so successful. The connection between the velocity of the Gulf Stream and the advent of the tidal wave on our coast has been accurately determined, and the credit for this important discovery is due to Lieutenant Pillsbury. Appendix No. 13 to the coast-survey report, 'On the harmonic analysis of the tides at Governor's Island, New York harbor,' by William Ferrel, shows the results of tidal observations. The report states that the tides at Governor's Island and at Sandy Hook are very similar. The epochs at Governor's Island are somewhat greater, and the tides are thus

twenty-nine minutes later, than at Sandy Hook. The tides are not affected by waves coming through Hell Gate from the tides in the Sound above. The results of Mr. Ferrel's analysis show that it is not necessary to make separate tide-predictions for both Sandy Hook and Governor's Island, since the latter may be obtained from the former by simply adding twenty-nine minutes to the times. Other important appendices to the coast-survey report for 1885 are, 'The geographical distribution and secular variation of the magnetic dip and intensity in the United States,' C. A. Schott; 'A plea for a light on St. George's Bank,' Henry Mitchell; 'On geodetic reconnaissance,' C. O. Bouteille; 'Note on a device for abbreviating time-reductions,' C. S. Peirce.

— The coast-survey steamer Patterson, which has been laid up since last October at the Mare Island navy-yard, is being overhauled and painted, to return to survey work on the Alaska coast early in the coming spring.

— Lieut. William H. Emory, who commanded the Bear on the Greely relief expedition, has been ordered to the Thetis, and will shortly sail for Alaska. He will investigate the seal-fisheries, and has received special instructions regarding the boundary-line between Alaska and the British possessions.

— The will of the late Isaac Lea was admitted to probate Jan. 23. The document is a voluminous one, and contains twenty codicils. The will bears date of execution May 25, 1878, and the final codicil July 30, 1885. The petition, which was filed by the executor with the document, places the value of the estate left by the decedent at about three hundred thousand dollars. He bequeathed his collection of fresh-water shells, marine and land shells, minerals, fossils, and geological specimens to the Academy of natural sciences of Philadelphia; but in a codicil dated Feb. 28, 1880, he says, "I revoke that part of my will which gives to the Academy of natural sciences at Philadelphia my collection of natural history, and I give them all to the national museum at Washington, D.C., on condition that the national museum shall devote a room exclusively for the Unionida, Stremopatida, Physaidea, Paludinaida, Pulmonifera, and others, the Unionida to be put in the exact order in which they now are, with their labels as I have placed them; the whole to be called 'The Isaac Lea collection;' the Muscovite collection to be placed in this room likewise." A codicil executed on Oct. 1, 1884, reads, "Believing it important to the early history of the development of the fluviatile and terrestrial Mollusca of the United States to have some of my corre-

spondence published, as well, also, some other subjects, I desire my executors to devote a thousand dollars to the object, provided they may agree with me in that opinion."

— A recent bulletin of the New England meteorological society states that the records of a meteor seen from many points in New England on the evening of September 6 were submitted to Prof. H. A. Newton of Yale college, who reported as follows: the meteor had an altitude of about 90 miles when first visible, over latitude $44^{\circ} 15'$, longitude $73^{\circ} 8'$; and an altitude of 25 miles when it disappeared, over latitude $43^{\circ} 20'$, longitude 71° . One of its explosions occurred near the middle of the path, the other near the end. The meteor was going away from the sun, having had a perihelion distance of about three-quarters of the earth-orbit radius. An extract is added from one of Professor Newton's earlier papers. The altitudes of 78 meteors observed on Nov. 13-14, 1863, were calculated as follows: mean altitude at first appearance, 96.2 miles; at disappearance, 60.8 miles; at middle path, 78.5 miles. Twenty-nine of these meteors became visible at greater height than a hundred miles, and seven disappeared before descending to this height. For 39 meteors observed on Aug. 10-11, 1863, the corresponding mean altitudes are 69.9, 56.0, and 62.9 miles (*Amer. Journ. sc.*, xi., 1865). It is desired that observers should report the position of bright meteors, noting their paths among the stars with as much accuracy and detail as possible. The drift of the trail left by the meteor should be closely observed, as it indicates the direction of upper winds. The simple record that a meteor was seen is of very little value alone.

— The use of salicylic acid has become so prevalent to prevent fermentation in food-products, that a committee of the Académie de médecine has had the matter under consideration, and, in a report recently made on the subject, says, "It being well established by medical observation that feeble and prolonged daily doses of salicylic acid and its derivatives can cause considerable trouble to the health of certain persons who are sensitive to those forms of drugs, particularly old people and in those whose venal or digestive functions are no longer in perfect order, therefore the addition of the salicylates to liquid and solid aliments will not be permitted."

— The agricultural appropriation bill reported last week from the committee on agriculture carries the following amounts for the support of this service during the next year: experiments with southern cane, \$32,000; experiments in silk-culture, \$15,000; slaughtering cattle, \$100,000; cattle quarantine, \$20,000. The total amount recom-

mended in the bill is \$563,730. The committee also recommend that the statistician of the department be sent to Europe to attend the international agricultural convention, and that \$15,000 be appropriated therefor.

— The report of Mr. J. R. Dodge, statistician of the U. S. agricultural department, on the sugar-production of the world, contains some interesting data. According to the figures presented, the amount of beet-root sugar produced in the season of 1886-87 exceeds the cane-sugar by 162,000 metric tons, thus showing that more than half the sugar used in commerce is extracted from the beet. The manufacture of beet-sugar is entirely a European industry. Mr. Dodge states that its success in Europe is largely due to the 'beet-stock' plan, where each shareholder in the stock of a beet-sugar factory is required to furnish so many beets per share. The farmers are therefore, in reality, the manufacturers, and, since they obtain the profits of the manufacture, they are the most interested in raising good beets at a nominal price. The total consumption of sugar in this country in 1885 was 1,245,574 tons, of which only 40,000 tons (or about three per cent) were produced here. There is only one beet-sugar factory in this country, and that is in California, which produces sugar at five cents per pound, and has to compete with free sugar from the Sandwich Islands. The report further states that our sugar-consumption amounts to about one-fourth of all the sugar reported from the countries of principal production, and that within twenty-five years more than 2,000,000 tons will be required, almost sufficient to swallow up the present production of beet-sugar, or the whole of the present cane-sugar of commerce. The report concludes as follows: "At a time when labor is in excess of demand, and corn and wheat and cotton, and other old staples of a primitive agriculture, exceed the wants of domestic and foreign markets, we scour the world for food-products costing more than \$200,000,000 per annum, the larger portion of which should be produced in the United States. This primitive and unenterprising situation must be surmounted by a more skilful, scientific, and inventive agriculture."

— The first number of the *Centralblatt für bacteriologie und parasitenkunde*, edited by Dr. Oscar Uhlworm of Cassel, is announced for the beginning of the present year. Professor Leuckart of Leipzig, and Dr. Loeffler of Berlin, are associated with Dr. Uhlworm. At the urgent request of the editor, Dr. George M. Sternberg, U.S.A., has consented to act as a collaborator in the United States. As its title implies, this pub-

lication is to be devoted to bacteriology in all its branches and to animal parasites which affect man, the lower animals, and plants. The editor is especially desirous of securing all original American papers relating to this field of investigation, whether recording experimental work or improvements in technique. Authors of such papers are kindly requested to send reprints to Dr. Sternberg, in care of Johns Hopkins university, Baltimore, Md.

— The new chemical laboratory of the University of Nebraska was dedicated Jan. 14.

— *Gaillard's medical journal* states that Dr. Valentine Mott has been making a series of preventive inoculations in the case of two sons and an office-boy of Dr. Foster of Yazoo county, Miss., who were bitten by a rabid dog in November. The process has been completed, and the children are all in good condition.

— Small-pox, which has been so notably absent from New York City, has now made its appearance there, eighteen cases having been reported during the week ending Jan. 22, of which two were fatal. 651 cases of measles with 86 deaths, and 130 cases of diphtheria with 38 deaths, are reported for the same period.

— Three new comets are announced. The first was discovered by Thome, Dr. Gould's successor at the Cordoba observatory in South America, on Jan. 18, in the constellation Grus. The despatch states that it resembles the great southern comet of 1880, and is likely to become a brilliant object. The second comet was discovered by Brooks on Jan. 22, in the constellation Draco, and in this latitude is now visible, with the help of a telescope, throughout the night. The third was discovered by Barnard on Jan. 23, and is in Vulpecula; it is also telescopic, setting in the early evening.

— Dr. F. V. Hayden, formerly director of the U.S. geological and geographical survey of the territories, has resigned from the position that he has held for several years in the present U.S. geological survey.

— Indianapolis, Ind., has been considerably excited of late over an instance of remarkable preservation of the human body after death. A lady died in that city some thirty years ago, and her body, incased in an iron coffin, was placed in a vault. A recent examination showed that the body was in a wonderful state of preservation. The *Indiana pharmacist* says that even the color of her eyes, a deep blue, could be recognized. The hair had grown to a length of two feet. It was supposed by the sexton to have turned to stone,

but further investigation showed it to have become changed into that peculiar substance known as adipocere. Adipocere (*adeps*, 'fat,' and *cera*, 'wax') has somewhat the appearance and consistence of cheese, and is a compound of oleic and margaric acids with an alkali. It has usually been formed in bodies that are buried in the earth, and moisture has been supposed to be essential in its formation. In the instance just referred to, the body was in a dry vault. There seems to be no fixed time necessary for this change to take place. One instance is reported of an infant which had been but three months in a cesspool, in which adipocere had formed, while in other cases years seem to have been necessary.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

National prosperity.

In Mr. Atkinson's paper in the *January Century* there are some uses made of statistics which seem to a layman at least a little queer.

He gives us a table of enormous percentages to show how greatly the United States have increased in productiveness and wealth.

Since 1865 we are told the yield of hay has increased 106 per cent; of cotton, 194 per cent; of grain, i.e., wheat, corn, oats, barley, rye, and buckwheat, 256 per cent; railway mileage, 280 per cent; insurance against fire, 310 per cent; output of pig-iron, 386 per cent; and population, 69 per cent. The ratios are seemingly wonderful, but in some cases very deceptive, most so in cotton. In 1865 the number of bales was 2,228,951, and in 1885, 6,550,215, a gain in twenty years of 194 per cent. Will it be surprising to be told that the gain is not 194 per cent, but only 22 per cent? Here it is.

In 1860 the number of bales recorded was 5,387,052, on which the gain in 1885 is but 22 per cent. Why does the statistician take the phenomenally low year of 1865, which was behind 1850 even? We have merely regained the position of 1860, and advanced 22 per cent.

And as to increase, the gain from 1850 to 1860 with slave-labor was 118 per cent, in ten years, — an average of $11\frac{8}{10}$ per cent per year, which, compared with the free-labor rate, $9\frac{7}{10}$ per cent per year, shows that the increased production under free labor is somewhat of a myth. At the slave-labor rate of increase, the twenty years from 1865 to 1885 would have culminated in a crop of 7,489,275 bales. In what, pray, does the superiority of free labor make itself manifest?

Population, we are told, has increased 69 per cent since 1865; from 1860 to 1870 the increase was 23 per cent, $2\frac{3}{10}$ per cent per year; from 1870 to 1880 it was 30 per cent, or 3 per cent per year; from 1880 to 1885 we find a gain of 14 per cent, or $2\frac{8}{5}$ per cent per year.

Now, from 1850 to 1860 the increase was 36 per cent, or $3\frac{6}{10}$ per cent per year, a higher rate than that of any decade since then. Had we increased from 1865 to 1885 at the rate of the decade before the war, we should now number over 61,000,000 instead of 56,975,000.

256 per cent, we are told, has our grain-crop increased from 1865 to 1885. The grain-crop of 1865 was over 100,000,000 bushels less than that of 1860. By decades we find that the increase between the years 1860 and 1870 was 32 per cent; 1870 to 1880, 50 per cent; and from 1880 to 1885, 23 per cent, or $3\frac{2}{10}$ per cent, 5 per cent, and $4\frac{1}{10}$ per cent per year respectively. The gain from 1850 to 1860 was 43 per cent, or $4\frac{3}{10}$ per cent per year; and if we calculate from 1860 to 1885 at the same rate, 43 per cent per decade, we find due us a crop of 3,060,428,664 bushels as against 3,014,063,984; and the marvellous gain of 256 per cent over 1865 appears less than was to be expected from what we were doing before the war. The hay-crop of 1882 would have amounted to about 600,000 tons more, if it had been the result of an increase as from 1850 to 1860. Since 1882 the hay-crop jumped from 38,000,000 tons to 48,000,000 in two years, a truly phenomenal increase.

Railway mileage has increased 280 per cent since 1865; but, if we are to talk of per cents, let this gain of twenty years be compared with 217 per cent, ten years' gain from 1850 to 1860. In miles the gain has been from 1850 to 1860, 21,500; 1860 to 1870, 22,400; 1870 to 1880, 40,700; 1880 to 1885, 32,000.

It would be of interest to see if the net income has increased *pro rata*.

For progress in wealth we are shown a table of fire-insurance risks, and an increase therein of 310 per cent since 1865. Why not take the assessed value of all real and personal property? This was, in 1850, \$7,000,000,000; in 1860, \$13,000,000,000; and in 1880, \$17,000,000,000. Of course, there is an increase since 1865, but in per cent it does not compare with that from 1850 to 1860.

As to pig-iron and its 386 per cent increase since 1865, it will take a pretty stiff-necked protectionist to understand how, under the conditions of its production, it stands for 386 per cent increase of wealth to the people who have to use it and pay for it.

And now, if, to make the showing a little more comprehensive, we look at the number of acres of improved land, we find that it increased 44 per cent from 1850 to 1860, 16 per cent from 1860 to 1870, and fifty per cent from 1870 to 1880, — an average of $3\frac{3}{5}$ per cent per year, — very close to the increase in population. The value of agricultural implements increases, from 1850 to 1860, 62 per cent; 1860 to 1870, 37 per cent; 1870 to 1880, 2 per cent; annual average, 4 per cent.

Rice production has fallen from 215,000,000 pounds in 1850 to 110,000,000 in 1880. Tobacco, which gave an increase of 117 per cent from 1850 to 1860, and in 1860 had 434,000,000 pounds, has but 472,000,000 in 1880.

Irish potatoes increase 69 per cent, 29 per cent, 18 per cent, respectively for the three decades, or the average of $3\frac{3}{10}$ per cent per year.

Sweet-potatoes fall from 38,000,000 bushels in 1850 to 33,000,000 in 1880. Cheese, also, which was at 105,000,000 pounds in 1850, is in 1880 only 27,000,000 pounds. Butter rises 46 per cent, 12 per cent, and 21 per cent through the three decades, an average of 2.6 per cent per year. Live-stock gains 100 per cent from 1850 to 1860, 40 per cent from 1860 to 1870, and falls off 6 per cent between 1870 and 1880, an average rate of increase of $4\frac{1}{5}$ per cent.

And while our public debt has been decreased by \$876,970,833 between 1865 and 1880, we find on hand in 1880 a state, county, and town debt of

\$1,056,406,208, which seems to show that the revenue which went to reduce the national debt has been diverted to local improvements, and has become a wealth-producing power.

Comparing, now, the average increase by decades since 1850, we find population at about 30 per cent per decade; hay, except for 1883 and 1884, 36 per cent; cotton, 40 per cent; grain, 42 per cent; railway mileage, 115 per cent; improved land, 37 per cent; agricultural implements, 40 per cent; Irish potatoes, 38 per cent; butter, 26 per cent; livestock, 47 per cent; assessed valuation, 40 per cent; while rice, sweet-potatoes, and cheese have decreased 50 per cent, 14 per cent, 74 per cent, tobacco is as in 1860, and our debts have simply changed form. This statement of average increases per decade shows how closely together the various values have kept for thirty-five years. The great advance since 1865 has now about brought us up to the place we should expect had the war not interrupted our development. Production has advanced only a little faster than population, and this is probably due to improved implements, improved methods, greater demand, and more facilities for handling the crops, i.e., railways.

C. H. LEETE.

New York, Jan. 22.

Professor Newberry on earthquakes.

In his notice of my article on earthquakes, in *Science* of Jan. 7, Mr. Everett Hayden intimates that I am not warranted in my statements in reference to the cause of earthquakes and the condition of the interior of the earth, citing the diversity of opinion which is on record, and the authority of great names opposed to me, as a reason why I should exhibit greater modesty.

I am sorry that I cannot see the matter from Mr. Hayden's stand-point. If he has any facts or arguments to offer which militate against the statements I have made, I shall be most happy to consider them, and I shall be convinced by them if they are convincing; but, without facts or new arguments, we may well be spared the appeal to authority. A blind deference to the utterances of great men has done geology much harm. Sir William Thomson has no more sincere admirer than myself, both for his genius and his nobility of character; and yet I do not hesitate to say, that by his unwarranted statements in regard to the condition of the interior of the earth, a matter in which his mathematical genius and learning give him no fitness to speak authoritatively, he has seriously retarded the progress of geological knowledge. From the phenomena of the tides and the precession of the equinoxes, he has inferred and asserted that the figure of the earth is as inflexible as though it were composed of glass or steel. There is, however, a doubt in the minds of many physicists whether the tides and the precession of the equinoxes afford such delicate and quantitative tests of the constancy of the earth's figure as to warrant these conclusions. Hennesy and Delaunay have shown that the argument from the precession of the equinoxes, at least, is weak; but, even if the fact of the constancy of the earth's figure be conceded, the inference that it is because of a rigidity of the earth's material equal to that of glass or steel, is certainly unwarranted. The argument proves too much: we all know that the materials composing the earth's

mass are *not* as rigid as steel. The facts connected with earthquakes, volcanoes, mountain-chains, and the oscillations of the level of coasts, which I briefly cited in my article, show conclusively that the earth is not an unyielding solid; and I have suggested that the want of homogeneity in the materials composing it, — partly solid, partly viscous, partly fluid, — under varying conditions of pressure, may neutralize the tendency to distortion from the changing attractions of the sun and moon. The facts cited by geologists as disproving the absolute rigidity of the earth are unquestionable, and their arguments are cumulative and unanswerable. Hence astronomers must find some other explanation of the constancy of the figure of the earth — if that be proved — than a solid interior.

I am only exercising my inalienable right, am defending my hearth and home, when I protest against the invasion of our field of research by masters in other departments of science, however gifted, who, with imperfect knowledge, hurry to conclusions incompatible with those which geologists have reached by lifelong study. That Sir William Thomson did not give to the geological facts due consideration when he uttered his dictum, is shown in his original paper read before the Geological society of Glasgow in 1879. Here in advocating the theory that the earth is solid, and that the solidification began at the centre, the result of the cooling and sinking of an external crust, he states that most substances are denser when cooled to solidification than when fused. In a footnote to p. 40 of the volume of the Transactions of the geological society of Glasgow which contains Sir William Thomson's address, is given a report of later experiments made to test this question by Mr. Joseph Whitley of Leeds, England, who found that iron, copper, brass, whinstone, and granite, the only materials he tested, were all less dense when solid than liquid.

This is not the only instance where men of deserved eminence in their own departments of science, without taking pains to inform themselves in regard to the facts of geology, have sought to teach geologists lessons which they have not themselves fully learned.

Sir Robert Ball, astronomer royal of Ireland, an able and distinguished man, whose merits have been suitably recognized in the office he holds, and the title conferred upon him, in his eloquent address entitled 'Glimpses through the corridors of time,' has proposed a theory, which, if accepted, would not only revolutionize all geological history, but would discredit the teachings of the most eminent geologists. In the circumstances, I have felt called upon to protest against this invasion of our domain, and have shown that the geological record affords conclusive evidence against this theory.

So Mendelieff, one of the most eminent of chemists, has proclaimed the inorganic origin of the Pennsylvania petroleum from an inferred absence of organic matter from which it could be generated. Here, also, I have ventured to show that a better knowledge of the geological structure of western Pennsylvania would have revealed to him the true source of the petroleum in enormous underlying organic deposits, and would have prevented the promulgation of a geological heresy.

Those only are capable of intelligently discussing and deciding these difficult problems in geology, who, with special tastes and abilities, have devoted lives

to their study. And I respectfully submit that no one should accept the geological generalizations of chemists, astronomers, and physicists until their utterances have been approved and accepted by those whom we recognize as the ablest and most authoritative expounders of our science. As regards origin of earthquakes and the condition of the interior of the earth, as well as the other questions I have mentioned, I must decline to retract the opinions I have advanced until they shall be met with new facts or better arguments than any yet offered.

J. S. NEWBERRY.

New York, Jan. 14.

A card to American geologists.

A meeting of the American committee of the International congress of geologists will be held in Albany from April 6 to April 9, 1887.

The object of this meeting is to perfect a scheme embodying the thoughts of American geologists on the questions of classification, nomenclature, coloration, etc., entering into the system of unification of geological science, which is the object of the International congress.

In order that the committee may represent the views of all geologists in the United States, it hereby invites from all, their individual opinions on any subjects likely to arise in the congress. Those who will meet the American committee in Albany are requested to send to the undersigned a note of the topic or topics they propose to treat, and the time which they will require. In cases where it is not convenient for them to go to Albany, they are requested to forward a statement of their views to the undersigned in writing before April 1, for presentation to the committee.

For information as to the kind of questions to be discussed, attention is called to the 'Report of the American committee,' published last spring, in which the debates in the third session of the International congress are reported.

The following are the sub-committees of the American committee: archæan, Hunt, Hitchcock, Winchell, Pumpelly; lower paleozoic, Hall, Winchell, Lesley; upper paleozoic, Hall, Lesley, Newberry, Stevenson, Williams; mesozoic, Newberry, Cook, Cope, Powell; Cainozoic (marine), Smith, Newberry; Cainozoic (interior), Cope; quaternary, recent, archeology, Powell, Winchell, Cook.

PERSIFOR FRAZER, *Secretary*.

Philadelphia, Jan. 22.

Loco-weed.

In your note on the 'loco-weed,' on p. 32 of *Science* for Jan. 14, reference is made to the belief of the Indians that an insect is the cause of the disease supposed to be produced in horses and cattle by eating this weed. In western Kansas there are two plants called 'loco' by the ranchmen. These are *Oxytropis lamberti*, Pursh, and *Astragalus mollissimus*, Torr. Specimens of the latter plant were brought to me a few days ago, whose lower stems were abundantly occupied by a stalk-boring insect larva. These insects are believed, not by Indians but by a certain physician, to be the cause of the 'loco' disease in horses by producing 'bots.' Moreover, this physician has frequently seen the horse bot-fly deposit its eggs

upon the leaves of the *Astragalus*. Henceforth let elementary entomology be added to the courses of study in our medical schools.

I may add, that Prof. L. E. Sayre, of the department of pharmacy of the University of Kansas, is making an exhaustive study of the 'loco' problem.

FRANCIS H. SNOW.

Lawrence, Kan., Jan. 16.

Spiders and the electric light.

Some disadvantage or evil appears to be attendant upon every invention, and the electric light is not an exception in this respect. In this city they have been placed in positions with a view of illuminating the buildings, notably the treasury, and a fine and striking effect is produced. At the same time, a species of spider has discovered that game is plentiful in their vicinity, and that he can ply his craft both day and night. In consequence, their webs are so thick and numerous that portions of the architectural ornamentation are no longer visible, and when torn down by the wind, or when they fall from decay, the refuse gives a dingy and dirty appearance to every thing it comes in contact with. Not only this, but these adventurers take possession of the portion of the ceiling of any room which receives the illumination.

It would be of interest to know whether this spider is confined to a certain latitude, and at what seasons of the year or temperature we can indulge in our illumination.

G. THOMPSON.

Washington, D.C., Jan. 24.

A pineal eye in the mesozoic Mammalia.

Among the large number of mesozoic genera which have been determined by Owen, Marsh, and others, only one genus has any considerable portion of the skull preserved. This is *Tritylodon*, a comparatively large animal from the upper triassic of South Africa, described and figured by Professor Owen in the *Quarterly journal* of the Geological society in 1884. In describing the cranium, he writes (p. 146), "A short anterior divarication [of the parietals] bounds a small vacuity exposing matrix which has filled the cerebral cavity; which vacuity is completed anteriorly by a similar divarication of the mid and hind angles of the frontal bones, the mid suture of which is unobliterated. The above vacuity, *v*, if natural, represents a fontanelle, or it may be interpreted as a pineal or parietal foramen; it may, however, be due to posthumous injury."

Now that the meaning of the pineal gland has been made clear, this observation is of very great interest and importance. *Tritylodon* is one of a large and widely spread group of mammals, represented by *Triglyphus*, from the triassic bone-bed near Stuttgart; *Bolodon*, from the English Purbeck (Jurassic); *Allodon*, from the American upper Jurassic; and *Polymastodon*, from the American lowest eocene, or 'Puerco.' From the large size of the parietal foramen in *Tritylodon*, which greatly exceeds that of any of the recent lizards in relative diameter, and compares with that of the labyrinthodonts and saurians, we may safely infer that the primitive Mammalia, of this family at least, had a pineal eye of some functional size and value.

HENRY F. OSBORN.

Princeton, N.J., Jan. 24.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 28, 1887.

HISTORY OF THE AGASSIZ ASSOCIATION.¹

As we begin the publication of a magazine devoted to the interests of the Agassiz association, it would seem to be necessary to rehearse to the large circle of acquaintances we now meet for the first time our history and our hopes.

Asking the indulgence, therefore, of our members, to whom the facts are already familiar, we will condense from addresses delivered in Philadelphia and Davenport as succinct an account as possible of the history and aims of our society.

The first hint that ever came to us of the formation of a society for the study of nature is found in one of Jacob Abbott's famous Rollo books, — 'Rollo's museum.' Published more than thirty years ago, that little black volume is still as good a guide as any known to me, to put into the hands of young persons who wish to organize themselves into a society. It was a half-conscious recollection of the pleasure I derived from reading this book when a child, that led me more than ten years ago to propose a similar society to the pupils in the Lenox high school.

The proposition was received with enthusiasm. Nearly half the school joined the society, which was first called, I believe, the Lenox high school scientific society. Our work was extremely simple. One boy kept a daily record of the temperature as indicated by a somewhat questionable thermometer; one kept the record of the weather, which was quite laconic, being something like this, "Monday pleasant, Tuesday rain, Wednesday cloudy, Thursday hot, Friday pleasant, Saturday rain." Then we began collecting specimens. I remember one boy collected buds from twenty or thirty different kinds of trees. He got them all on the same day, and, by comparing them, learned something about the times of leaf development.

One expedition was made to study the sections of trees that had been cut down. We wished to find whether the heart is always in the middle of the tree or not. We found it always nearest the coldest and windiest quarter. "Ye see, the wind blows the wood away from the heart," a contemplative rustic explained; thus unconsciously illustrating the tendency of untenable theory to follow in the wake of observed phenomena. With

these and other simple observations our little society busied itself, and prospered for several years. At one time there were on my desk about a hundred cocoons of curious form. One of the boys had found what he called 'pea-pods growing on a lilac-bush,' and brought these cocoons all gathered from one tree. Each was enclosed in a lilac-leaf curiously folded around it. At that time I had never seen a cocoon yield up its imprisoned life. One day our school was visited by Mr. George Walton, one of the Massachusetts board of education. It so happened that while he was listening to some recitation or other, I noticed one of the pea-pods acting in a strange manner. It rolled over of its own accord.

I quietly picked it up and handed it to Mr. Walton without a word. While he held it in his hand, there emerged one of those beautiful creatures known as *Attacus promethea*. It hung down from the dry cocoon by its fore-legs, and slowly expanded its wonderful wings. None of us had seen the bursting of a chrysalis before, and we were all deeply interested and delighted. We then told him of our little society, and showed our other treasures. He urged us to tell our plans to friends about us, and to show them our specimens. So, at a convention of teachers that met soon after, I gave a short account of the matter, and, opening a satchel, covered the table with specimens which had been gathered and prepared by the children. The thing seemed to them so pleasant and so simple and easy to do, that at the close of the meeting no less than fifty teachers crowded around the table to examine the bugs and butterflies, the stones and woods, flowers, ferns, and grasses, and to ask all sorts of questions. Several similar and corresponding societies were formed.

About the same time there appeared in the *New England journal of education* a short article by Count Pourtales (a former pupil of Professor Agassiz) on the subject of school scientific societies. From this article we first learned of the Swiss societies of like nature, and of the boys and girls who wear badges of green fir and go together for frequent field and forest excursions. Thus gradually grew the thought of extending to others what had proved so pleasant to ourselves; and as the *St. Nicholas magazine* had organized, and for a time maintained, a society called 'The bird-defenders,' it was natural to apply to that magazine for space in which to print an invitation to

¹ From the first number of *The Swiss Cross*.

all who might be interested to join us in our work. This request was granted, and the invitation appeared six years ago, and was widely accepted.

The word 'association' was chosen instead of 'society' from an impression, perhaps not entirely well founded, that that word could be taken to mean 'a union of societies,' just as society means 'a union of individuals.' And our first plan was to have these local societies entirely independent of one another, except in the general name and in the purpose of studying nature. At that time no conventions were thought of, assemblies were not in mind, courses of study had not been contemplated, a badge was not designed, nor had we supposed it possible that thorough scientific work could be systematically done by many of the chapters, if at all.

We chose the name 'Agassiz' because it was then uppermost in mind. His then recent death was fresh in the hearts of the nation; and his birth in Switzerland, where a similar organization was said to exist, rendered it especially appropriate. The choice was wiser than we knew. No one can read Mrs. Agassiz's life of her husband without feeling that no name could better stimulate us to faithful work.

Having thus selected the name, a letter was sent to Prof. Alexander Agassiz, asking permission publicly to adopt it. Professor Agassiz replied that he cordially assents that this very pleasant and useful plan for children be called the Agassiz association, and that we have his hearty good wishes for its success.

The societies that joined us during the first year or two of our existence, when our plans were still uncertain and our methods comparatively crude, retain in many cases the notion that the Agassiz association to-day is the same loose organization it was at first, — an aggregation of local societies united only in name, allowed to drift hither and thither without direction or assistance. But the necessity for careful supervision and guidance has grown more and more apparent. We have been constantly besieged with requests for 'systematic courses of study,' elaborate plans of work, personal counsel and advice. Courses of study have accordingly been added, plans of work sketched, and a regular system of reports established. The conditions of admission have been defined, and, in short, more business-like methods adopted, until we now resemble rather an extended school with numerous classes than an ordinary society.

What, then, is the Agassiz association as it appears to-day? And what claims has it upon the interest of the public? It is a union of 986 local societies, each numbering from 4 to 120 members,

of all ages from 4 to 84. Our total membership is above ten thousand. We are distributed in all the states and territories with very few exceptions, and have strong branch societies and active members in Canada, England, Ireland, Scotland, Chili, Japan, and Persia.

The 986 local societies are known as 'chapters.' They take their names from the towns where they are established, and are further distinguished by the letters of the alphabet. Thus the first chapter established here was called New York (A); the second, New York (B); and so on.

I may mention four different sorts of chapters. First, family chapters. The parents and children of a single family unite for joint study and research. Chapters of this sort are especially desirable, and prove almost uniformly permanent. Chapters of another sort are found in schools. There are many teachers able and willing to give their strength and time, beyond the exacting requirements of their contracts, to the encouragement and assistance of their pupils. Under the fostering care of such men and women, the happiest results have been accomplished. Not the least important result is seen in the pleasant personal relations thus established between teacher and pupil. Chapters of a third kind are organized and conducted entirely by young persons. A company of girls or boys meet together, and decide to form a branch of the A. A. They elect their officers, draft their rules and by-laws, engage their rooms, build their cabinets, make their collections, prosecute their studies; and, if I needed to awaken interest or arouse enthusiasm, I should have only to show what our girls and boys have done even when unaided and alone. They have made lists of all the flowers that grow about them, and of all the birds that fly over their heads. They have published papers, started museums, founded libraries. In doing this they have mastered the laws of parliamentary debate; have learned to observe with accuracy, to write with fluency, to speak with power; and, after working thus for a few years, many of them have pushed themselves into schools and colleges and laboratories of the highest grade, and are now completing their self-appointed preparation for lives of commanding intelligence and cheerful service. Finally I will mention chapters of adults. In increasing numbers, men and women of mature years, feeling the need of that scientific training which the schools of their childhood failed to give, are organizing societies, joining their influence to our association, and receiving in return the benefits coming from united endeavor and from enthusiastic devotion to a common cause. But, excellent as the work of all these chapters is,

we have found some needed work beyond their individual attainment. A general convention, for example, could hardly be received and cared for by a single chapter; nor could a wide range of local observations be properly collated and discussed by the inhabitants of a single town. It has therefore been deemed wise to bring about the union of all the chapters of a city or a state into more extended organizations than the single chapter. These confederations of chapters are called 'assemblies;' the two most prominent at present being the Philadelphia assembly, and the State assembly of Iowa.

Embracing all the little chapters, binding into one the larger and more powerful assemblies, and making room also for individuals when chapters cannot well be formed, is our Agassiz association. There are 986 chapters, about 6 actual and 40 potential assemblies, but only one association. And the influence and prosperity of each assembly can be increased and perpetuated by spreading everywhere we go a knowledge of our local work not only, and of our local organization, but also, and even with more emphasis, a knowledge of our entire association, with its broader membership and its farther-reaching aims.

Our association is not by any means great or powerful. As yet it is young, it is ignorant, it is weak. We have no occasion for vain-glory. Yet, on the other hand, while we have no excuse for vanity, neither need we feel vexation of spirit. Our purposes are good, our methods right. In spite of our feebleness, in the face of our ignorance, critics have been indulgent, and we have been more encouraged and praised for what we have tried to do than derided for our failures or censured for our faults. Scientific men of highest repute, men like Ramsay of England, and men like Agassiz, Hyatt, Winchell, Remsen, Gould, Gilman, and Scudder of America, have extended to us the hand of recognition.

The press has almost always been indulgent; and, although we have often exposed ourselves to fair attacks of satire, our real desire to do honest work has somehow turned the most caustic pen to kindness.

In speaking of our helpers, I should be unjust if I failed to mention with renewed gratitude and honor the large number of scientists who have voluntarily devoted their valuable time to the cheerful and patient assistance of our needs. More than fifty gentlemen representing all departments of science hold themselves always ready to answer the questions that puzzle us. Thanks to their benevolence, the boy who lives in the remotest and smallest village can send his bit of stone or his curious beetle to one of these men,

and learn its name and history, and, better still, be taught how he may best study by himself its structure and its history. Some of these professors have even volunteered to conduct courses of study in various branches. We have had courses in botany, entomology, and mineralogy. The course in mineralogy recently finished by Professor Crosby of Boston has been especially successful. One hundred and forty-four chapters or individuals took this course, and completed it not only to our satisfaction, but to our surprise and delight.

It seems at first thought difficult, if not impossible, to suggest any general principle of study that can apply to the whole association, for it is composed of elements so diverse.

We are of all ages, of varying capacities and differing desires, living in places widely distant and strangely different. Some of us pick our violets in June, others in January.

But there is a common ground on which all stand, — love for nature, and desire to learn. And there is one principle that underlies and determines the methods of our study. It is this: Nature must be studied from her own book.

While, therefore, we do not undervalue the printed records of others' work, and while we ever recognize in printed books and papers necessary and cherished guides, yet we believe that our first business is to meet Nature face to face. Therefore we leave the confines of the library and school, and go out under the open sky, — into the forest, and along the stream.

Forgetting theory and useless wrangling, it is our purpose to see things as they are, and to record them as we see them. It is the business of the Agassiz association to live for the truth.

Many of those who first joined our ranks are growing out of childhood into manhood and womanhood. Many adult chapters, too, are forming; and perhaps to-day one-quarter of our total membership may be over twenty years of age. What can we do for this increasing class? In the first place, we can give them the opportunity to help the younger, even as they themselves have been helped while young. It is to them, the scientists of the future, that we must soon look for special help, instruction, and guidance. Meanwhile we need them still among us to encourage us by their example, and to aid us by their work. And we want to help them too. We must provide higher courses of study, — discover the best books for students more advanced, and help those who need it to secure the best instruction. I was greatly pleased this summer, while resting by the sea, to find in the laboratory at Annisquam, among the twenty-five earnest workers who were bending day after day, and night after night, over the

dissecting-table and the microscope, no less than seven men and women who either are or have been members of the Agassiz association. Here is the moral of it: youthful observation of nature, wisely directed, grows into manly and womanly consecration to science.

Now, one thing our association ought to do in the near future is to secure control of one or more tables in this and other thoroughly equipped laboratories, and place them year by year freely at the disposal of such of our number as may show themselves worthy. May we not in time hope to establish here and there laboratories of our own, manned by our own professors?

We wish also to establish courses of study with greater regularity, and of wider range. I should like to see a yearly correspondence course in each of the branches of natural science, conducted by the best teachers of America. I should wish these courses, specimens included, to be absolutely free; and I should wish the men who give them well paid for their time and work.

At present, as we depend entirely upon volunteers, our courses, though frequent, are rather desultory, and accompanied with some slight expense for specimens and printing. To do all we hope to do will cost much money, and the money must be raised. The Agassiz association must be endowed, and the money will come, as time and devoted labor have long since come. There are plenty of wealthy men and women ready to give money as soon as we can prove that it can be given safely, worthily, and well. Now, here we have a school of more than ten thousand pupils, confined to no one city, no one state, no one denomination. We have a corps of fifty volunteer instructors. We need no expensive buildings. And if we find that in order to meet the needs of our maturing membership we need a fund of ten or twenty or fifty thousand dollars, whose income shall be applied to giving worthy young men and women a chance to work under competent instruction, I have faith to believe that some man will be found deep enough in pocket, and broad enough in heart, to endow the Agassiz association as he might a collegiate chair or a private school. Let each chapter and each member be like Diogenes, ever peering about with lighted lantern to find this man.

But we need not wait for that. There is enough we can do unaided; and, indeed, I am inclined to think that labor voluntarily expended by boys and girls in building their own cabinets, and by girls in decorating and caring for their assembly-rooms, is the cause of the truest satisfaction and enjoyment, and is also productive of the greatest interest in the weightier matters of scientific study.

You can see most clearly through a microscope that you have worked and waited for.

If the endowment ought to come, it will come in due time; but in the mean while let each continue to do his best where he happens to be. The way to help the whole association is to give your best attention to your individual work. Let the little ones gather their pebbles and their flowers. Let the elder look more closely into the structure and the habits of bird, or beast, or plant. Let us all be always living for the truth, and striving to read in every leaf of Nature's book her lesson of faith, her lesson of hope, her lesson of love.

Admirably has one of our Iowa chapters united science and humanity. Organized as a society of scientific workers, it has made itself also a band of mercy. It has proved, that, although the eye of Science is keen, her heart need not be cold, and that her hand, however cunning, may yet be kind. Two kindred spirits were Agassiz and Audubon; and very many who, with us, have enrolled themselves under the name 'Agassiz,' have also joined the Audubon society, while many others are learning—regarding birds not only, but every living thing—never needlessly to hurt or to destroy.

But Agassiz was not only merciful: he was devout. Before opening his famous school at Penikese, he bowed his head in silent prayer; and, as the ocean-breeze gently lifted his whitening locks, every head was bowed with reverence, and it seemed as though the Spirit of God were there. We therefore beg our members, as they walk through this fair garden of the Lord (and this thought I echo from the lips of Dr. Parkhurst), not to let the beauty of the creation hide from them the face of the Creator. We do not believe that faith is inconsistent with intelligence, hope at variance with knowledge, or love opposed to science. "The garden of the Lord should not conceal the Lord of the garden." Let us study with the eye not only, but with the heart; and may we all be lifted to a sweet consciousness of Nature's ministrations, the beauty of her handiwork, the music of her singing, and the tenderness of her love.

HARLAN H. BALLARD.

A CRITICISM OF PASTEUR.

AT the meeting of the Paris academy of medicine, Jan. 4, Professor Peter, the well-known antagonist of Pasteur's theory, read a paper concerning a case of death by hydrophobia after preventive inoculations.

It seems that a cart-driver by the name of Réveillac was bitten in the finger some time since by a mad dog. Twenty-four hours after the accident the wound was cauterized; and the next day, fol-

lowing the advice of some friends, the man went to Pasteur to be submitted to his treatment according to the new method, which was explained in a recent 'Paris letter' to *Science*. Matters progressed favorably till the 12th of December (the accident was early in November). On that day Réveillac felt pain, at first slight and afterwards more severe, in the points where the inoculations had been made, while no pain was felt in the bitten finger. This important point was testified to by the patient himself and by the persons who lived with him, and it has been corroborated after careful investigation.

Following this pain were other symptoms, prominent among which was a general feeling of restlessness and great weakness. The weakness was so great, even on the first day, that the patient, on being advised to visit Pasteur and ask for relief, answered that he wished to, but felt utterly unable to do so. The second day the weakness increased, and the patient could hardly eat. He died on the 16th of December. During the last two days of the illness, the attending physicians witnessed symptoms in the throat of an impossibility of swallowing liquids. There were no convulsions, but only weakness and paralysis.

Professor Peter called attention to the facts, first, that the premonitory pain was not in the finger where the original poison had entered, but at the points where the inoculations had been made; second, that the other symptoms had not been those of common rabies, but of experimental hydrophobia. Instead of convulsions, paralysis was the principal symptom.

A discussion followed the reading of the paper, and the objections were made that it was by no means certain that Réveillac had died from rabies, that paralytic rabies is very rare among men, and that many symptoms of that disease were wanting. Professor Peter's criticism is, however, interesting, and is likely to attract attention. It is unfortunate, however, that we have no certain proof that Réveillac died from the inoculations. If care had been taken to inoculate animals from the tissues likely to be most affected in the patient, we should have had a better basis for deciding on the merits of the case.

THE RUBY-MINES OF BURMAH.

FOR some time past a considerable share of European political and military interest has centred in south-eastern Asia. The fact that in at least one of the countries of that region, Burmah, precious stones are reputed to be found in great quantities, will attract attention of a different order. In view of the report that British troops

were about to take possession of the Burmese ruby-mines, a correspondent of the London *Times* has furnished that journal with a description of them and an estimate of their probable value.

It seems that most of our information concerning these mines comes in a more or less amended form, from the account of Tavernier, — information of two hundred years ago, to be sure, but still the basis of all subsequent accounts. He describes the place where the rubies are obtained as "a mountain twelve days' journey or thereabouts from Siren (i.e., Siriam) towards the north-east, and it is called Capelan (i.e., Kyat-pyen). It is the mine whence is obtained the greatest quantity of rubies, spinelles, or mothers of rubies, yellow topazes, blue and white sapphires, hyacinths, amethysts, and other stones of different colours. . . . Siren is the name of the city where the King of Pegu resides, and Ava is the port of the kingdom. From Ava to Siren you ascend the river in large flat boats, and it is a voyage of about sixteen days. You cannot travel by land on account of the forests, which abound with lions, tigers, and elephants. It is one of the poorest countries in the world: nothing comes from it but rubies, and even they are not so abundant as is generally believed, seeing that the value does not exceed 100,000 crowns per annum. Among the multitude of these stones you would find it difficult to meet with one of good quality, weighing three or four carats, because the king does not allow any to be removed till they have been seen by him, and he retains all the good ones which he finds among them."

Two other authorities, men who have visited these mines during this century, are Father D'Amato, who saw the mines about 1830, and a Mr. Bredemeyer, who was in charge of mines in the vicinity about 1868.

Father D'Amato's account is that Kyat-pyen is situated about seventy miles to the north-east of Mandalay. The gem-gravel occurring there was reached by pits of from twenty to thirty feet in depth; but extensive working, owing to the influx of water, was impossible with the primitive methods followed by the miners. Besides rubies, sapphires, topaz, and oriental emeralds were also found, and spinelles were abundant. All stones above a certain weight became the property of the king, provided they were not stolen and smuggled away. Facilities for this were, however, afforded by the visits paid to the mines annually by merchants from China and Tartary.

Still more recent visitors to Mandalay have found that the majority of the rubies found are less than a quarter of a carat in weight, and the larger ones are generally flawed. Sapphires,

though rare, are occasionally found of from nine to thirteen carats in weight and without flaw. The revenue from these mines, which has been a royal monopoly, amounted in 1856 to about fifteen thousand pounds sterling annually.

As to the benefits to accrue to the new owners, the *Times* correspondent is sceptical. He says that to sanguine minds the prospect may appear tempting, and it may be thought that with proper mining appliances, and under British management, these mines might be made to yield a rich return. It may prove to be so, but "experience in India and Ceylon under more favorable circumstances of position does not justify that conclusion."

BRITISH CENTENARIANS.

THE British medical association assigned to one of its committees the task of inquiring into the medical history of the very aged. In answer to their widely distributed circulars, they have received a large number of records; and, of these, fifty-two cases refer to persons claiming the age of one hundred years or over. The detailed tables with regard to these fifty-two centenarians are published by Professor Humphrey, F.R.S., in a supplement to the *British medical journal* (Dec. 11 and 25, 1886). It is not meant to be implied that all these cases are beyond question: in only eleven cases (two males and nine females) was the age confirmed by baptismal or other records; and in the rest of the cases one can safely say that they were very, very old. It is satisfactory to find that in these tables the well-known pride of longevity and love of exaggeration have not induced any one to claim so high an age as 110: 108 and 106 are the highest ages recorded.

Thirty-six of these fifty-two are women: this excess undoubtedly indicates that females are more apt to reach these extreme ages than men; but it also indicates that females are more apt to lay claim to extremelongevity, and the ratio of 36 to 16 must be discounted accordingly. The average age of females, as well as of males, is slightly over 102 years; 11 were single (of these, 10 were females), 5 were married, and 36 widowed. The average age of marriage for the men was 31 years; for the women, 25 years. The average duration of married life for the former was over 54 years; for the latter, over 33 years. The average number of children was about six: only one male and one female had no children. The centenarian has a tendency to be among the first-born children: in thirty-eight returns his average position is about the second or third child, and in twelve cases is he the first (and in two of these the only) child. Only 3 of 49 spent their lives in afflu-

ence; 28 were in comfortable circumstances, and 18 were poor. The returns of their past condition show a remarkable unanimity as regards their health: they are a robust race, and spare as opposed to stout. They are not subject to ailments, as a rule, and show some remarkable cases of recovery in old age. One had epilepsy from 17 to 70 years; another an abscess connected with the spine, a stiff knee from injury at 50, and other troubles; a third had acute bronchitis at 95; and a fourth, paralysis at 90.

The qualities most frequently mentioned in these life-histories are a good family history; a well-made frame of average stature; an equable development of all the organs, including especially a good digestion, ready sleep, keen but not large appetite; retention of the hair and teeth; and little use of stimulants. Their habits, on the whole, show them to be, as a class, early risers, great out-door exercisers, and moderate in all indulgences.

The average height of the males is 5 feet 8½ inches, and their weight 138 pounds; of the females, 5 feet 3 inches, and their weight 129 pounds. Twenty-two report good hearing, and 34 good sight. Of 35, 28 use glasses, and 4 of the other 7 probably could not read. Fourteen describe themselves as placid in disposition, 8 as irritable, 11 as energetic, 8 as placid and energetic, and 5 as irritable and energetic. Of 46, 29 are reported as possessing average intelligence, 5 have low and 11 high intellects. The memory for recent events is good in 26, bad in 6, and moderate in 7. Similar figures for the memory for past events are 39, 4, and 4, showing the greater tenacity of early associations. One "remembers and will quote a great deal of the Bible;" another could "repeat about one hundred Psalms correctly." Of 45, 7 smoked much, of which 4 were women. The average time of going to bed was 9 o'clock, and of rising 8 o'clock. The average chest girth in inspiration was 36½ inches in the men, nearly 31 inches for the women; in expiration, 36½ inches and 30 inches. The slight differences indicate a weakening of the respiratory activity. The average pulse is 75, and the respiration 24, per minute. Of 42, 24 had no teeth; among 37 cases, there were 144 teeth, of which 63 were in the upper jaw (19 incisors, 8 canines, and 36 molars), and 81 in the lower jaw (23 incisors, 13 canines, and 45 molars). Evidences of debility are, of course, not rare: they occur in half the cases, and are connected with the heart in two cases, with the heart and lungs in 3, heart and urinary organs in 3, with the lungs in 2, with the brain in 3, brain and urinary organs in 1, urinary in 4.

Dr. Humphrey concludes his comments upon these cases with the hopeful consideration that the result of the investigation is found to be that "the means most suited for prolonging life . . . are the means best calculated to turn it to good account and to make it happy."

THE MELANESIAN RACES AND LANGUAGES.

SOME of the most perplexing problems of ethnology are encountered in Oceanica. As is well known, this vast island world, stretching eastward from south-eastern Asia far into the Pacific ocean, is commonly divided into five geographical provinces, — Malaisia, or the East Indian archipelago, extending from the Straits of Malacca to New Guinea; Melanesia, comprising New Guinea and the groups east of it to the Fiji Islands; Polynesia, including the islands of the southern and eastern Pacific, from New Zealand to the Hawaiian group; Micronesia, the range of small islands in the North Pacific, east of the Philippines; and Australasia, comprising Australia and Tasmania. The tribes that inhabit these various regions differ in all the traits which are supposed to indicate distinction of race. The Malays are short, with light-brown complexion, straight black hair, and small Siamese features. The Polynesians are tall, of clear yellow hue, with wavy black hair, and handsome, almost European countenances. Of the swarthy Melanesians, some, like the Papuans, are tall, with prominent, aquiline features, and frizzled locks; others, like the Negritos and Samangs, are short, with woolly or tufted hair. The Australians are black or reddish brown, with negroid features and wavy or crispy hair; while south of them the now extinct Tasmanians had similar features and complexion, with completely woolly hair. The question to be decided is, Do all these tribes belong to one race, or to two, or to many? Ethnologists of the highest ability and attainments — Crawford, Pritchard, Huxley, Wallace, Lesson, Von der Gabelentz, Winchell, and many others — have taken part in the discussion, and we seem as far from a definite conclusion as ever.

The latest and perhaps the most valuable contribution yet made to the evidence on this subject is the comprehensive and profound work of the Rev. Dr. Codrington on the Melanesian languages. The materials for the work were gathered during many years of missionary labor spent chiefly on Norfolk Island, in the Melanesian mission-school

of the Anglican church. Australasia is not included within the scope of the work, and New Guinea is only noticed in some incidental allusions; but all the groups lying east of that island, and extending from New Ireland southward to New Caledonia, and eastward to Rotuma and the limits of Polynesia, are illustrated by it. No less than thirty-four languages and dialects are carefully described, and are compared with one another and with the idioms of Melanesia and Polynesia, as well as with the language of Madagascar, which, as is well known, belongs to the Malayo-Polynesian family. Dr. Codrington is an Oxford scholar, versed in classical studies, and familiar with the methods and results of philological research. To a student of linguistic science it is no small pleasure to peruse a work in which the laws of the science, as they have been wrought out by the ablest minds in the study of the Indo-European and Semitic tongues, are applied with a happily illuminating effect to the languages of these barbarous tribes.

The first result is to raise considerably our opinion of the quality of the languages, and our estimate of the intellect of those who speak them. The author finds these idioms remarkably copious. Of this fact he gives an interesting illustration from his own experience with one of them, — that of the island of Mota, of which many of the pupils in the Norfolk Island school were natives. "After some twelve years' acquaintance with the language, talking, teaching, and translating," he writes, "and after having acquired, more or less correctly, a considerable vocabulary of Mota words, I began to buy words that I did not know at the rate of a shilling a hundred from the scholars at Norfolk Island. I left off when lists of three thousand words unknown to me had come in. It is certain that elder natives living at Mota use many words hardly known to those who have gone away from their own island as boys, and that the boys had by no means exhausted their stock. I calculate, therefore, that there were probably as many words still to come as would bring up my vocabulary to at least six thousand words. Of these, many, of course, are compound and derivative; but they are distinct words. This concerns a small island, with less than a thousand inhabitants, with whom European intercourse began within the memory of living men." This fulness, it should be added, is not merely in names of objects and actions. Purely abstract terms are common, and are formed by a system of derivation as clear and regular as that of the Greek or the Sanscrit. Thus from *toga* ('to abide') we have *togara* ('behavior') and *togava* ('station'). *Nonom* ('to think') yields *nonomia* ('thought'); and

tape ('to love') has for its noun *tapeva* ('love'). As Dr. Codrington remarks, "the presence of abstract words like these, among people of whom it is said 'that they are unable to conceive an abstract idea,' is worthy of notice."

A no less important result brought out by this work is the clear proof it presents that all these languages are nearly allied, and that they all belong to the Malayo-Polynesian family. Of this fact, no one who examines the excellent comparative grammar and the extensive vocabularies given in this volume can entertain a doubt. The question at once arises, How shall we explain this singular connection of speech between tribes so widely different in physical traits?

Three explanations have been offered. The first supposes that all these islands were originally occupied by one race, — a yellow or light-brown people, with straight hair, — and that the differences have been caused, in the course of ages, by the slow effects of climate and other natural influences. In this view, Oceanica would be a microcosm, repeating within its limits the ethnological phases which the world at large has displayed on a wider scale. A second theory is that which is favored by Dr. Codrington, and maintained by him with much force of argument and many illustrative facts. He supposes that the whole archipelago was at first occupied by a dark-skinned and woolly-haired people, originally issuing from Asia, and speaking the primitive language from which all these Malayo-Polynesian dialects are derived. At a later day, a light-complexioned race, allied to the Siamese and other nations of south-eastern Asia, entered the islands by slow and gradual migration, took wives from among the Melanese, adopted their language, and finally, by their inherent and superior vigor, displaced them entirely in many of the islands, and partially in others. This ingenious theory would explain why only one family of languages exists throughout the Melanesian region, if such were the case. It collapses, however, in the presence of some important facts which the learned author has not sufficiently considered. One of these facts is the ascertained existence in New Guinea of several languages radically distinct from those of the Malayan stock. Dr. Codrington himself remarks that three New Guinea vocabularies, furnished to him by Mr. McFarlane of the London mission society, contained no words that he knew; that is, no words of Malaisian origin. These were from south-eastern New Guinea, opposite the Australian coast. In the north-western part of the island, the German missionaries have studied the language of Mafor, near the Bay of Dorey, and have translated por-

tions of the scriptures into it. A careful analysis of this language is given by Prof. F. Müller in his comprehensive work, 'Elements of linguistic science' (*Grundriss der Sprachwissenschaft*). Many words in it, as he points out, are derived from the Malay; but these are clearly modern additions, several of them being actually of Arabic origin. The grammar and the mass of the vocabulary are peculiar. Professor Müller's conclusion is, that the Malay-speaking Melanese are a mixed race, derived from a mingling of yellow Malaysians with an aboriginal black race. This theory, in a certain way, accords with that of Dr. Codrington; but it differs from it in supposing that the Malayo-Polynesian language belonged originally, not to the black, but to the yellow race.

For this conclusion there is evidence which seems, on philological grounds, to be decisive. The vocabularies show that the Malaisian words which appear in the Melanesian dialects are usually corrupted, distorted, and abridged, having undergone the same fate which the Latin words experienced in the pronunciation of the Celts and Iberians of Gaul, when these barbarians adopted the speech of their Roman conquerors. Thus, the Malaisian *api* or *aft* ('fire') becomes in various Melanesian dialects *av*, *ev*, *eu*, *iei*; *ika* ('fish') dwindles to *ig*, *eg*, *ie*; *bua* or *fua* ('fruit') is transformed into *vua*, *hue*, *we*, *wi*, *oi*; *telinga* ('the ear') assumes the various forms of *teliga*, *tikga*, *dole*, *koroi*, *kuli*, *taia*. Similar contractions and corruptions pervade the entire vocabulary. It is clearly as impossible to hold that the fuller Malaisian words are derived from these briefer forms as it would be to suppose that the Latin *factum*, *pater*, *canis*, and *oculus* had their originals in the French *fait*, *père*, *chien*, and *œil*.

There can be little doubt that the view of Professor Müller is the correct one, and that the Melanese of whom Dr. Codrington treats are a people of mixed origin, deriving their language mainly from the Malayan race, and their physical traits, in varying proportions, partly from that race, and partly from a negroid race, which is still found, nearly if not quite unmixed, in many parts of New Guinea. It is but just to say that the author puts forth his own theory merely as a suggestion, and does not allow it to influence in any manner his treatment of his subject. Nothing could be more satisfactory than the general method of his work, its lucid style, its precision and completeness. Several good maps afford useful aid to the student. The volume must be ranked among the best of the many valuable acquisitions which ethnological science owes to missionary zeal and scholarship.

H. HALE.